

Topography of Arid Lands

Chapter 18

Specialized Environment

Special Conditions in Deserts –

Weathering- mostly mechanical

Different Soil and Regolith- little soil or regolith exposing bedrock to erosion

Soil Creep – minor in desert slopes

Impermeable surfaces- most surfaces are impermeable to percolating water

Special Conditions in Deserts

Sands – Deserts have lots of sand

Sand cover allows water to infiltrate- inhibits drainage via streams or overflow

Sand is readily moved by heavy rains

Sand can be shifted and shaped by the wind

Rainfall - much of the rainfall in the desert areas is intense, often coming from convective thunderstorms.

Fluvial Deposition – all streams are ephemeral- effective agents of erosion

Wind – most deserts don't have wind as a large effect- some have high winds but not all

Basins of Interior drainage - areas of drainages that never make it to the ocean - such as the Great Basin

Vegetation – perhaps the most important condition- the lack of vegetation has the effect on the topography

Water in Waterless Regions

Running water is by far the most important external agent of landform development

Surface Water in the desert

Exotic Streams- permanent streams in dry lands (where the water comes from adjacent mountains or wetter areas) and have sufficient volume to survive to the ocean- examples Colorado River or Nile River

Desert Lakes – dry lake beds – called playas or salines if there is a large amount of salt present

Playas- are the flattest, most level of all landforms

Saline lakes – permanent lakes in desert areas,
Great Salt Lake is a good example

Fluvial Erosion in Arid Lands

Differential Erosion - whenever a land surface erodes, variations in rock type and structure produce differences in the slope and shape of the resulting land form.

Results – cliffs, pinnacles, spires

Residential Erosional Surfaces - steep-sided mountains called inselbergs- these resemble “island mountains”

A type of inselberg is called a bornhardt.

Desert Stream Channels- normally dry beds of ephemeral streams

Called arroyos, gullies, washes or coulees

Fluvial Deposition in Arid Lands

Piedmont- generic term meaning any zone at the foot of a mountain range

Piedmont Zone – one of the most prominent areas of fluvial deposition

Piedmont Angle- a pronounced change in the angle of slope at the mountain base

Characteristics of Desert Surfaces

Erg – a large area covered with loose sand generally arranged in some sort of dune formation by the wind

Reg – Stony deserts – tight covering of coarse gravel pebbles, and/or boulders removed by wind and water sometimes called desert pavement

Desert Varnish – dark shiny coating consisting mostly of iron and manganese oxides that forms on the surface of pebbles, stones, and larger outcrops of rock

Hamada – Barren Bedrock- a barren surface of consolidated material- usually consists of exposed bedrock

The Work of the Wind

Aeolian Processes – those related to wind action

Aeolian Erosion

Deflation- the shifting of loose particles as a result of their being blown either through the air or along the ground

Abrasion- the same as fluvial abrasion except that the Aeolian is less effective – Require “tools” in the form of airborne sand and dust particles – Doesn’t construct- merely sculpts what is already there

Aeolian Transportation

Rock material carried by the wind much like in the water but less effectively

The is done by “**saltation**” and “**traction**”

Large particles move by traction

Small particles are moved by saltation

Entire surfaces moves in a “creep” not like the soil creep

Aeolian Deposition

Sand and Dust Moved by Wind eventually deposited into sand plains or sand dunes

Desert Sand Dunes – composed entirely of unanchored sand that is mostly uniform grains of quartz - three kinds of dune patterns

Kinds of Dunes

Barchans- best known- occurs as an individual dune migrating across a non-sandy surface

Crescent Shaped- with horns point down wind

Form where strong winds blow consistently and can be the fastest moving

Transverse – also crescent shaped but less uniform

Occur where the supply of sand is much greater than the area where Barchans are found

All crests are perpendicular

Seifs – long narrow dunes – usually occur in multiplicity and in a generally parallel arrangement

Origins are not well understood

Rare in American deserts

Coastal Dunes

Wind active in dune formation along many stretches of ocean and lake shores

Loess – a form of Aeolian deposit not associated with dry lands

A wind- deposited silt that is fine grained, calcareous and usually buff colored

Lacks horizontal stratification

Vertical durability

Two Characteristics Desert Landform Assemblages

Most common desert landform is a mountain or mountain range flanked by plains

Basin and Range Terrain

Mesa and Scarp Terrain

Basin-and-Range Terrain

Land largely without external drainage

Has few exotic rivers flowing through or out of the region

Three principal features – ranges, piedmont zones, and basins

Ranges – dominate the horizons

Prevalence of steep and rocky slopes

Ridge crests & peaks are usually sharp steep cliffs

The ranges have been eroding for a long time

The Piedmont Zone

At the base of the ranges, a sharp break in the slope (the piedmont angle)

Transition area from slopes of ranges to the near flatness of the basin

Alluvial Fan- found at the mouth of canyons where streams empty and deposit their debris

Bajada or Piedmont Alluvial Plain- where alluvial fans build up and join together

Beyond the piedmont is the flattish floor of the basin

Low point is usually in a playa

Drainage channels across the basin floor sometimes clear cut but more often shallow and ill defined, frequently disappearing before reaching the low point

Salt accumulations are commonplace

Sometimes the water runs into playa lakes

Extensive but shallow

Persist for only a few days or weeks

Basin floor is covered with very fine-grained material

Death Valley is example of Basin and Range Terrain

Mesa and Scarp Terrain

Mesa (Table)

Scarp (Short for escarpment)

Normally associated with horizontal sediment strata

Differential erosion shows up prominently

Resistant strata weather and erode into mesas or scarps

The more easily eroded strata yield the gentler the inclined slope

Much of the undermining done by a process called sapping- groundwater seeps and trickles out of the scarp face, eroding fine particles and weathering the cohesion of the face

Types of topographic features of mesa and scarp terrain

Plateau- erosional platform- bounded on one or more sides by a prominent escarpment

Butte or Mesa – smaller topographical features formed by mass wasting

Pinnacle- or pillar, a final spire of resistance

Examples of mesa and scarp terrain-Badlands of Utah or Wyoming

Arches and Natural Bridges of Utah